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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,348	10/20/2003	Stephan Grunow	TI-36564	4206
23494	7590	03/09/2005	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			FARAHANI, DANA	
			ART UNIT	PAPER NUMBER
			2829	

DATE MAILED: 03/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/689,348

Applicant(s)

GRUNOW ET AL.

Examiner

Dana Farahani

Art Unit

2829

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Specification***

1. The disclosure is objected to because of the following informalities: element 36 on page 2, lines 16 and 17 is repeated twice.

Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of Yanagiya et al., hereinafter Yanagiya (US Patent 5,610,422).

Regarding claim 1, AAPA discloses in figure 1 of the instant application, a low K dielectric layer 20 with an upper surface formed over a semiconductor 10; a first trench (the trench at the left) formed in the low K dielectric layer wherein the trench has sidewalls; a first contiguous barrier layer 40 formed to a thickness X1 over the upper surface of the low dielectric layer and formed to a thickness X2 on the trench sidewalls; and copper 45 formed over the first barrier layer.

AAPA does not expressly disclose X1 being greater than X2.

Yanagiya discloses in figure 2C, a barrier layer 20 is formed over the trench shown in the figure, and is made such that its thickness over the upper surface of the element regions around the trench is larger than that of the thickness inside the trench. With this configuration, Yanagiya teaches, the breakdown voltage of the device on the trench lining (in this case a transistor) can be compensated against the concentration of an electric field on the thick portion of the film 20 (see column 5, lines 59-66). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to make X1 greater than X2 in AAPA in order to insure good insulating properties from the devices than utilize the trench interconnect structure, and would appear over the trench interconnection, without the need to make the barrier layer as thick inside the trench structure.

Regarding claims 2, 8, and 12, AAPA discloses a second trench comprising sidewalls (this is the trench shown at the right of the first trench) formed in the low K dielectric layer and separated from the first trench by a distance. Although, AAPA in view of Yanagiya does not disclose the distance being less than 160 nm, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the distance in accordance with the particular application in which the interconnect structure would be used. See *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990) for the proposition that when the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom, the Applicant must show that the chosen dimensions are critical.

Regarding claim 3, the first contiguous barrier layer 40 is formed to a thickness X2 on the sidewalls of the second trench.

Regarding claims 4, 5, 7, and 11, AAPA in view of Yanagiya renders obvious the claimed invention, as discussed above, except for expressly disclosing the ratio X1 to X2 being greater than 3 to 2. It would have been obvious to one of ordinary skill in the art at the time of the invention to determine the ratio of the distances X1 to X2 in accordance with the particular application in which the interconnect structure would be used. See *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990) for the proposition that when the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom, the Applicant must show that the chosen dimensions are critical.

Regarding claims 6, 9, 13, and 16, Yanagiya discloses in figure 8C, a second barrier layer 15 formed over a first contiguous barrier layer 16 and beneath the conductive connection 16.

Regarding claims 10, 14, and 15, AAPA in view of Yanagiya renders obvious the claimed invention, as discussed above, except for expressly disclosing the low K dielectric layer having a dielectric constant less than or equal 3.7. It would have been obvious to one of ordinary skill in the art at the time of the invention to determine the kind of material that would be suitable as the dielectric layer in accordance with the availability and cost of the material, and also in what particular application the interconnect structure is going to be used. See *In re Leshin*, 125 USPQ 416, for the proposition that it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use.


*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dana Farahani whose telephone number is (571)272-1706. The examiner can normally be reached on M-F 9:00AM - 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571)272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

D. Farahani



**B. WILLIAM BAUMEISTER  
SUPERVISORY PATENT EXAMINER**